US011445649B2

(12) **United States Patent**
Sanji

(10) **Patent No.: US 11,445,649 B2**
(45) **Date of Patent: Sep. 13, 2022**

(54) **COMPONENT MOUNTING SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/258,286**

(22) PCT Filed: **Aug. 1, 2018**

(86) PCT No.: **PCT/JP2018/028861**
§ 371 (c)(1),
(2) Date: **Jan. 6, 2021**

(87) PCT Pub. No.: **WO2020/026379**
PCT Pub. Date: **Feb. 6, 2020**

(65) **Prior Publication Data**

US 2021/0144891 A1 May 13, 2021

(51) **Int. Cl.**
B23P 19/04 (2006.01)
H05K 13/04 (2006.01)
H05K 13/02 (2006.01)
H05K 13/08 (2006.01)

(52) **U.S. Cl.**
CPC ***H05K 13/021*** (2013.01); ***H05K 13/0417*** (2013.01); ***H05K 13/0452*** (2013.01); ***H05K 13/086*** (2018.08)

(58) **Field of Classification Search**
CPC H05K 13/021; H05K 13/0452; H05K 13/0417; H05K 13/086
See application file for complete search history.

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(57) **ABSTRACT**

A component mounting system that includes a unit exchange device configured to automatically exchange the component supply unit and a processing section configured to determine whether the attachment and detachment of the component supply unit is performed according to the attachment and detachment instruction based on the attachment and detachment record acquired by an acquisition section and the instruction list, and when it is determined that the attachment and detachment is performed according to the attachment and detachment instruction, to perform an update process to update the instruction list by deleting the corresponding attachment and detachment instruction.

4 Claims, 9 Drawing Sheets

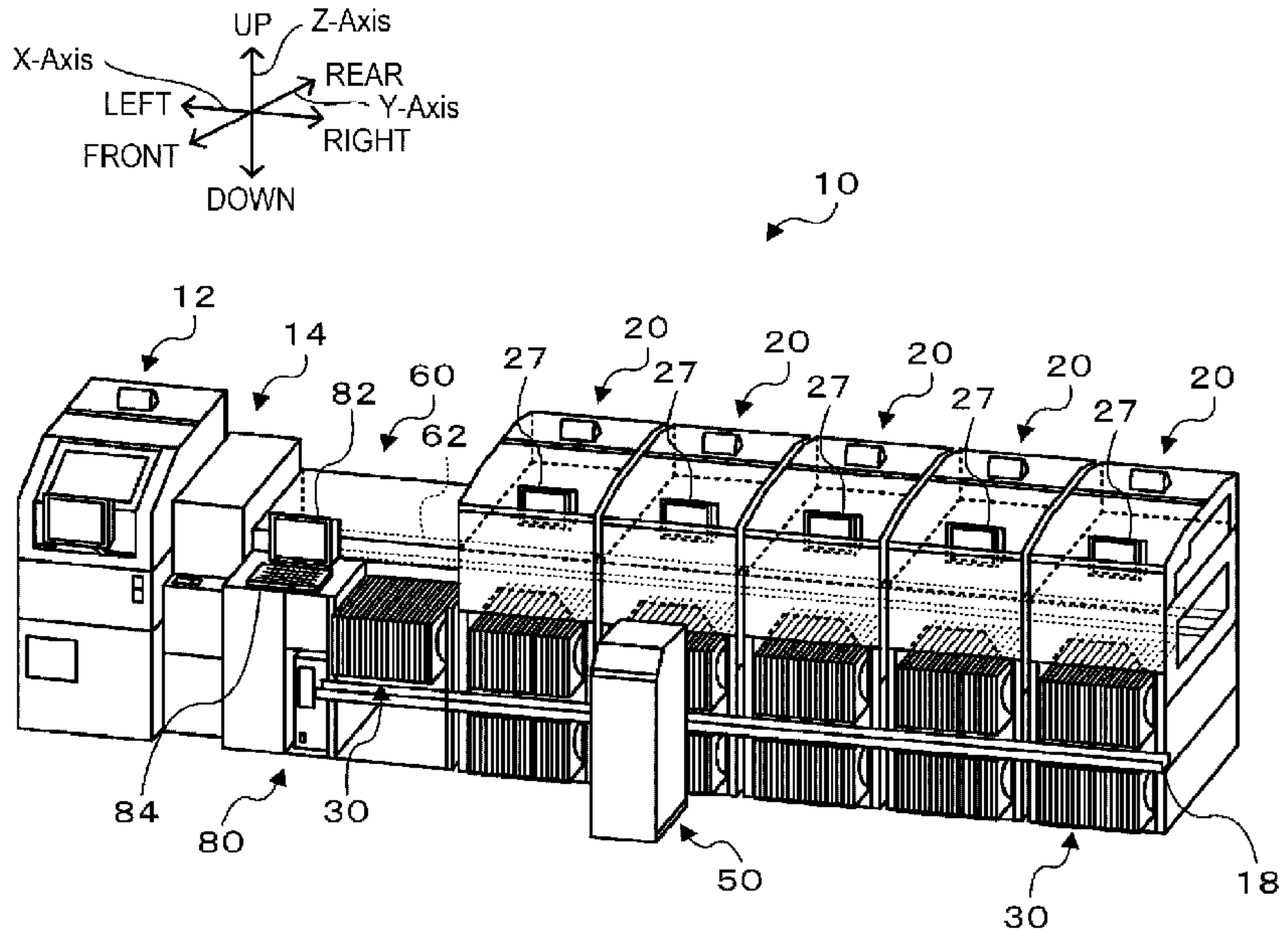
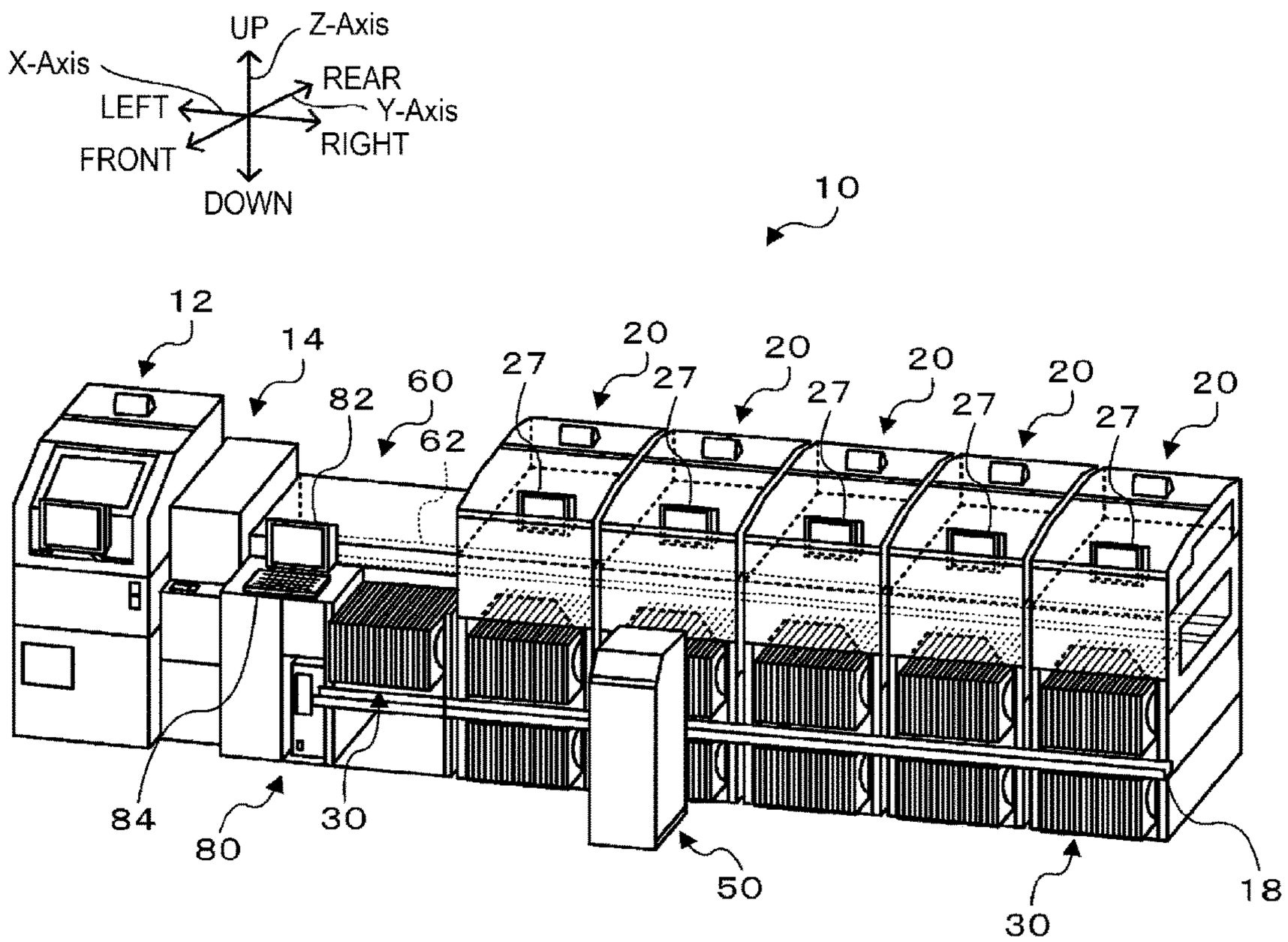


Fig. 1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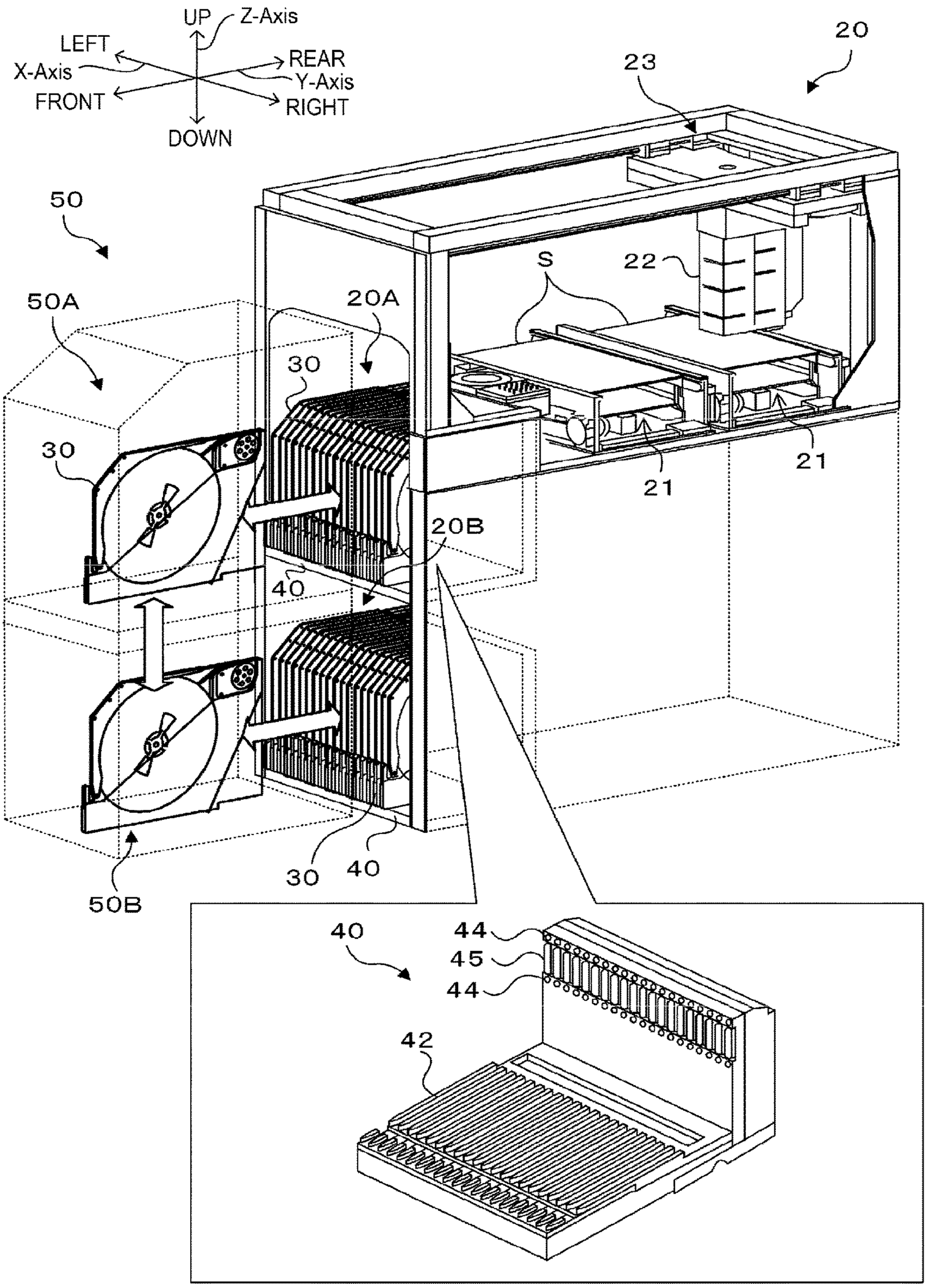
Z-Axis
X-Axis
REAR
LEFT
Y-Axis
RIGHT
FRONT
DOWN
10
12
14
82
60
62
27
20
84
80
30
50
18

Fig. 2


UP
Z-Axis
LEFT
X-Axis
REAR
Y-Axis
FRONT
RIGHT
DOWN
20
23
50
S
22
50A
20A
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30
21
21
20B
40
30
40
50B
40
44
45
44
42

Fig. 3

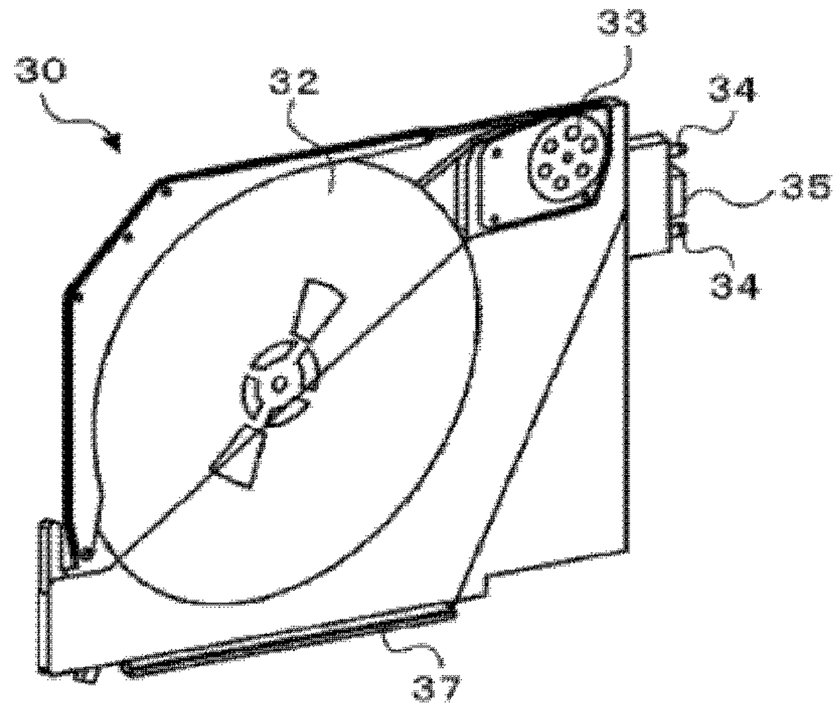

30
32
33
34
35
34
37

Fig. 4

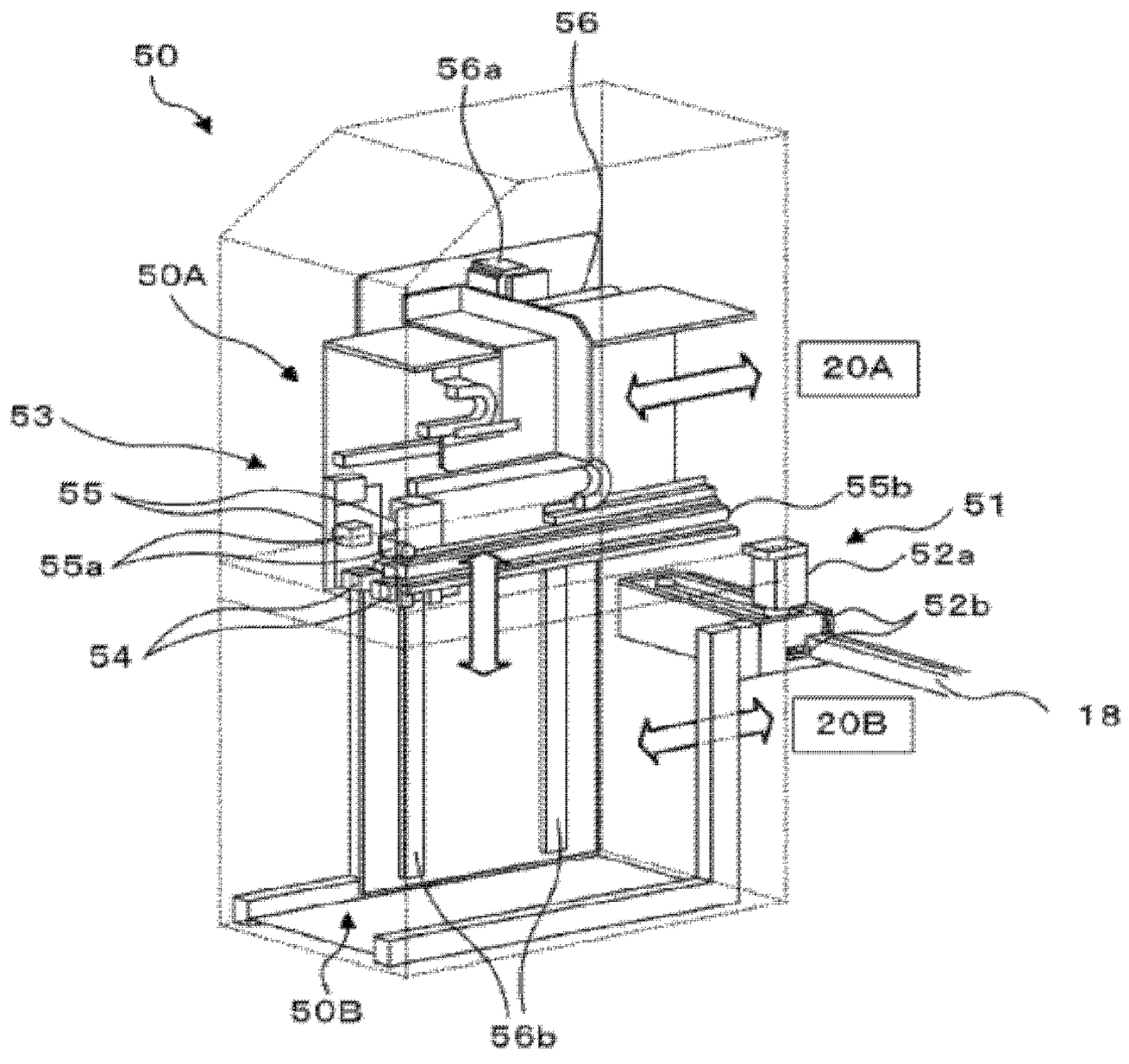

50
56
56a
50A
20A
53
55
55b
51
55a
52a
52b
54
18
20B
50B
56b

Fig. 5

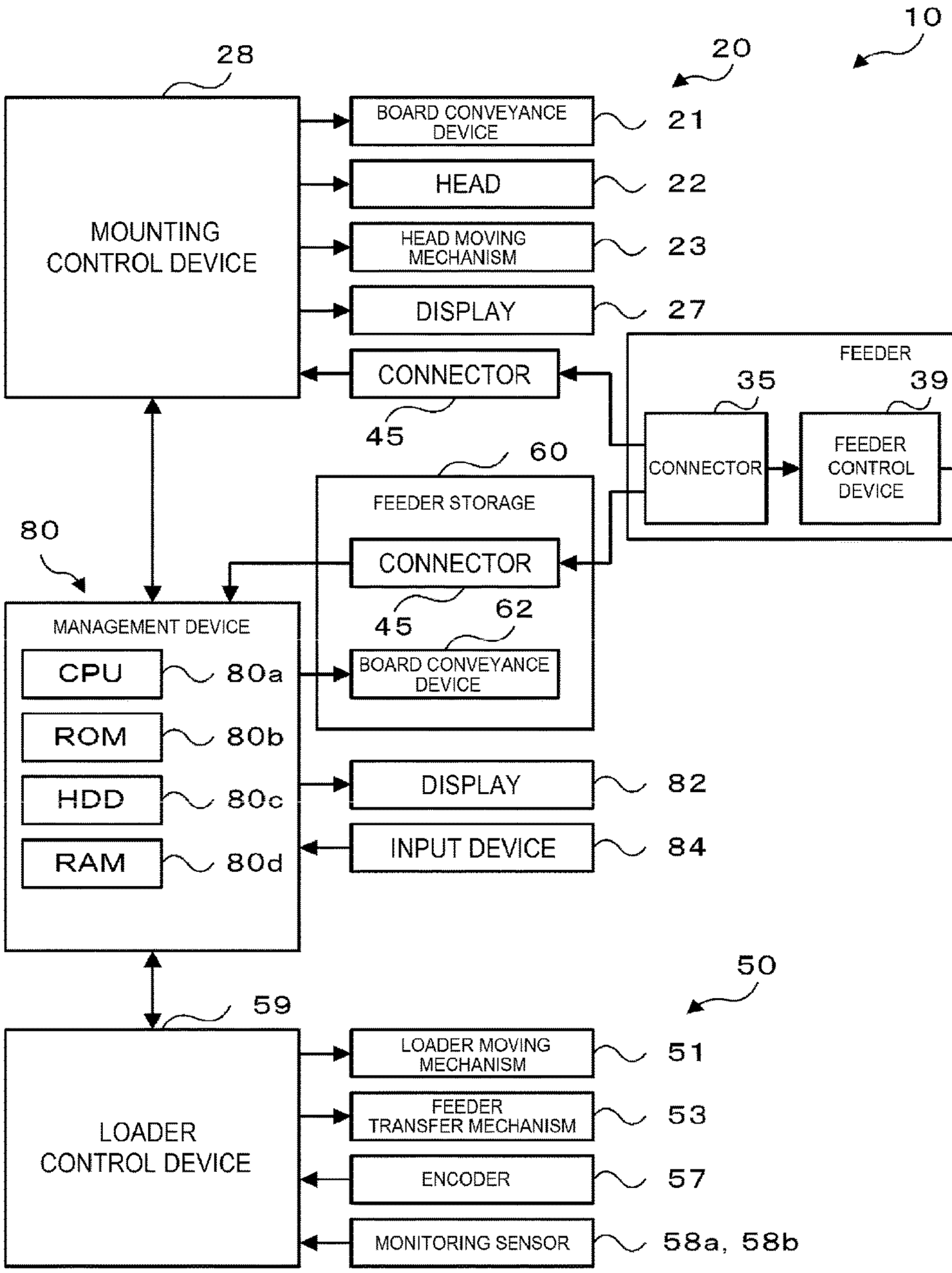
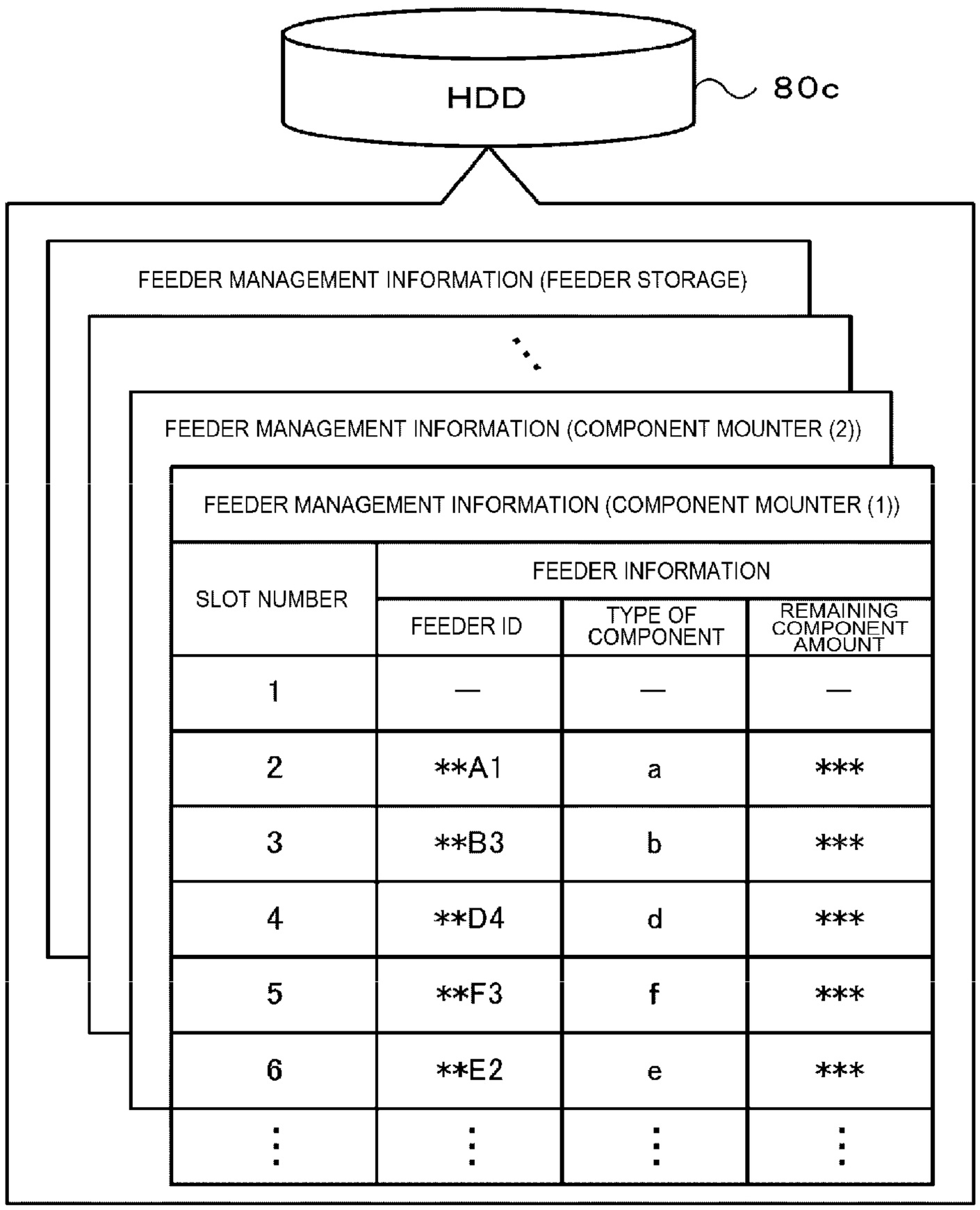

10
28
20
BOARD CONVEYANCE DEVICE
21
HEAD
22
MOUNTING CONTROL DEVICE
HEAD MOVING MECHANISM
23
30
DISPLAY
27
FEEDER
CONNECTOR
35
39
33
45
CONNECTOR
FEEDER CONTROL DEVICE
TAPE FEEDING MECHANISM
60
FEEDER STORAGE
80
CONNECTOR
45
62
MANAGEMENT DEVICE
CPU
80a
BOARD CONVEYANCE DEVICE
ROM
80b
HDD
80c
DISPLAY
82
RAM
80d
INPUT DEVICE
84
50
59
LOADER MOVING MECHANISM
51
LOADER CONTROL DEVICE
FEEDER TRANSFER MECHANISM
53
ENCODER
57
MONITORING SENSOR
58a, 58b

Fig. 6



SLOT NUMBER	FEEDER INFORMATION		
	FEEDER ID	TYPE OF COMPONENT	REMAINING COMPONENT AMOUNT
1	—	—	—
2	**A1	a	***
3	**B3	b	***
4	**D4	d	***
5	**F3	f	***
6	**E2	e	***
⋮	⋮	⋮	⋮

Fig. 7

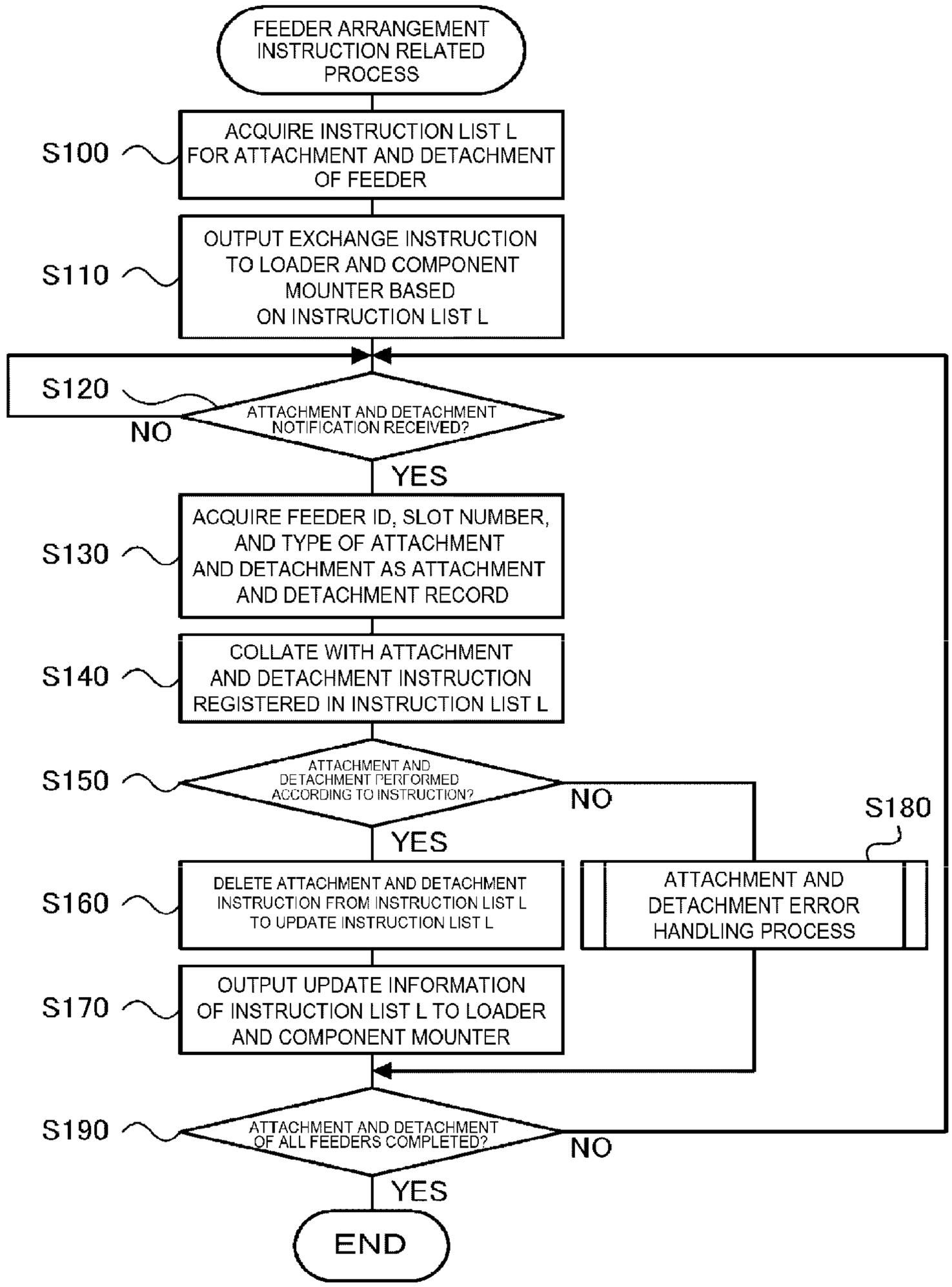

FEEDER ARRANGEMENT INSTRUCTION RELATED PROCESS
S100
ACQUIRE INSTRUCTION LIST L FOR ATTACHMENT AND DETACHMENT OF FEEDER
S110
OUTPUT EXCHANGE INSTRUCTION TO LOADER AND COMPONENT MOUNTER BASED ON INSTRUCTION LIST L
S120
ATTACHMENT AND DETACHMENT NOTIFICATION RECEIVED?
NO
YES
S130
ACQUIRE FEEDER ID, SLOT NUMBER, AND TYPE OF ATTACHMENT AND DETACHMENT AS ATTACHMENT AND DETACHMENT RECORD
S140
COLLATE WITH ATTACHMENT AND DETACHMENT INSTRUCTION REGISTERED IN INSTRUCTION LIST L
S150
ATTACHMENT AND DETACHMENT PERFORMED ACCORDING TO INSTRUCTION?
NO
YES
S160
DELETE ATTACHMENT AND DETACHMENT INSTRUCTION FROM INSTRUCTION LIST L TO UPDATE INSTRUCTION LIST L
S180
ATTACHMENT AND DETACHMENT ERROR HANDLING PROCESS
S170
OUTPUT UPDATE INFORMATION OF INSTRUCTION LIST L TO LOADER AND COMPONENT MOUNTER
S190
ATTACHMENT AND DETACHMENT OF ALL FEEDERS COMPLETED?
NO
YES
END

Fig. 8

INSTRUCTION NUMBER	ATTACHMENT AND DETACHMENT INSTRUCTION				
	FEEDER ID	TYPE OF COMPONENT	TARGET	SLOT NUMBER	TYPE OF ATTACHMENT AND DETACHMENT
1	**A1	a	IN-LINE STORAGE	2	DETACHMENT
2	**B5	b	IN-LINE STORAGE	5	DETACHMENT
3	**G1	g	IN-LINE STORAGE	13	DETACHMENT
4	**I3	i	IN-LINE STORAGE	19	DETACHMENT
5	**A1	a	MOUNTER(1)	4	ATTACHMENT
6	**B5	b	MOUNTER(1)	5	ATTACHMENT
7	**D3	d	MOUNTER(1)	7	ATTACHMENT
8	**H4	h	MOUNTER(1)	9	ATTACHMENT
9	**G1	g	MOUNTER(2)	1	ATTACHMENT
10	**I3	i	MOUNTER(2)	2	ATTACHMENT
11	**D3	d	IN-LINE STORAGE	2	ATTACHMENT
12	**H4	h	IN-LINE STORAGE	5	ATTACHMENT
⋮	⋮	⋮	⋮	⋮	⋮

L

Fig. 9

20(1)

27

FEEDER ID	TYPE OF COMPONENT	SLOT NUMBER	TYPE OF ATTACHMENT AND DETACHMENT		TARGET	SLOT NUMBER	TYPE OF ATTACHMENT AND DETACHMENT
**A1	a	4	ATTACHMENT	⇦	IN-LINE STORAGE	2	DETACHMENT
**B5	b	5	ATTACHMENT	⇦	IN-LINE STORAGE	5	DETACHMENT
**D3	d	7	DETACHMENT	⇨	IN-LINE STORAGE	2	ATTACHMENT
**H4	h	9	DETACHMENT	⇨	IN-LINE STORAGE	5	ATTACHMENT
⋮	⋮	⋮	⋮		⋮	⋮	⋮

Fig. 10

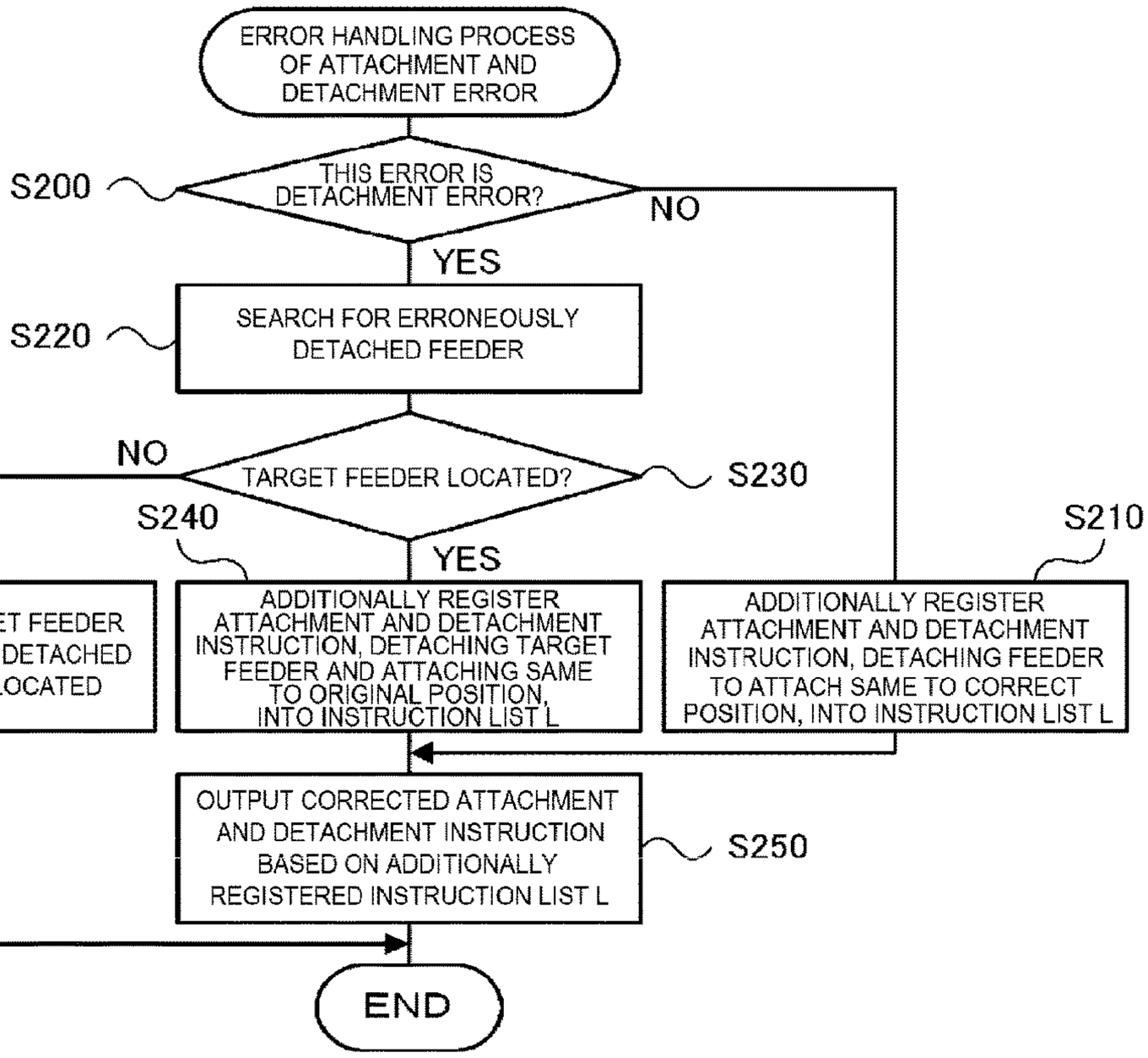


Fig. 11

ADDITIONAL REGISTRATION →

INSTRUCTION NUMBER	ATTACHMENT AND DETACHMENT INSTRUCTION				
	FEEDER ID	TYPE OF COMPONENT	TARGET	SLOT NUMBER	TYPE OF ATTACHMENT AND DETACHMENT
⋮	⋮	⋮	⋮	⋮	⋮
* 1	**B5	b	MOUNTER(1)	6	DETACHMENT
6	**B5	b	MOUNTER(1)	5	ATTACHMENT
7	**D3	d	MOUNTER(1)	7	DETACHMENT
8	**H4	h	MOUNTER(1)	9	DETACHMENT
⋮	⋮	⋮	⋮	⋮	⋮

L

Fig. 12

INSTRUCTION NUMBER	ATTACHMENT AND DETACHMENT INSTRUCTION				
	FEEDER ID	TYPE OF COMPONENT	TARGET	SLOT NUMBER	TYPE OF ATTACHMENT AND DETACHMENT
⋮	⋮	⋮	⋮	⋮	⋮
* 2	**F2	f	IN-LINE STORAGE	2	DETACHMENT
* 3	**F2	f	MOUNTER(1)	6	ATTACHMENT
7	**D3	d	MOUNTER(1)	7	DETACHMENT
⋮	⋮	⋮	⋮	⋮	⋮

L

ADDITIONAL REGISTRATION

ADDITIONAL REGISTRATION

COMPONENT MOUNTING SYSTEM

TECHNICAL FIELD

The present specification discloses a component mounting system.

BACKGROUND ART

Conventionally, in a component mounting system including a component mounter on which a cassette-type component supply unit (feeder) for supplying components is detachably mounted, a system including an exchange device for automatically exchanging the component supply unit has been proposed (for example, refer to Patent Literature 1). In this system, an exchange timing of each component supply unit is set based on a production plan of boards and a remaining amount of components in each component supply unit, and the exchange device is controlled so that the component supply unit can be attached and detached to be automatically exchanged at that exchange timing.

PATENT LITERATURE

PTL 1: WO2017/33268A1

BRIEF SUMMARY

Technical Problem

Incidentally, in the component mounting system described above, not only the exchange device but also an operator may attach and detach the component supply unit to the component mounter. For example, when it takes a long time to exchange the component supply unit by only the exchange device alone, in some cases, the operator may cooperate to exchange the component supply unit. In such a case, if information on the component supply unit attached or detached by the operator is not transferred to the exchange device, or the information on the component supply unit attached or detached by the exchange device is not transferred to the operator, it becomes difficult to appropriately exchange the component supply unit.

The main object of the present disclosure is to appropriately perform a cooperative operation between the exchange by the operator and the exchange by the unit exchange device in a case of automatically exchanging the component supply unit.

Solution to Problem

The present disclosure has taken following means to achieve the main object described above.

A component mounting system that includes a component mounter in which multiple component supply units that supply components are detachably arranged, the system including: a unit exchange device configured to automatically exchange the component supply unit between the unit exchange device and the component mounter; an instruction output section configured to output an exchange instruction of the component supply units, including an automatic exchange instruction to the unit exchange device, so as to be recognizable by an operator, based on an instruction list in which multiple attachment and detachment instructions are registered, in which a type of attachment and detachment, indicating the attachment or the detachment, are associated with identification information identifying the component supply unit targeted to be attached and detached, and positional information for the attachment and detachment in the component mounter; an acquisition section configured to acquire an attachment and detachment record that includes the identification information on the component supply unit, the positional information on the attachment and detachment, and the type of attachment and detachment when the component supply unit is attached and detached on the component mounter; and a processing section configured to determine whether the attachment and detachment of the component supply unit is performed according to the attachment and detachment instruction based on the attachment and detachment record acquired by the acquisition section and the instruction list, and when it is determined that the attachment and detachment is performed according to the attachment and detachment instruction, perform an update process to update the instruction list by deleting the corresponding attachment and detachment instruction.

The component mounting system in the present disclosure outputs the exchange instruction of the component supply units including the automatic exchange instruction to the unit exchange device so as to be recognizable by the operator based on the instruction list in which multiple attachment and detachment instructions are registered. Therefore, the attachment and detachment of component supply unit can be performed not only by the unit exchange device but also by the operator. In addition, in the component mounter, if the attachment and detachment of the component supply unit is performed, whether the attachment and detachment of the component supply unit is performed according to the attachment and detachment instruction is determined based on the attachment and detachment record and the instruction list, and when it is determined that the attachment and detachment is performed according to the attachment and detachment instruction, the update process to update the instruction list is performed by deleting the corresponding attachment and detachment instruction. Therefore, it is possible to appropriately prevent the attachment and detachment of the component supply unit already performed by any one of the unit exchange device and the operator from being performed by the other. Therefore, in the system where the component supply unit can be automatically exchanged, it is possible to appropriately perform the cooperative operation between the exchange by the operator and the exchange by the unit exchange device.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a configuration view illustrating an outline of a configuration of component mounting system **10**.

FIG. **2** is a configuration view illustrating an outline of a configuration of component mounter **20**.

FIG. **3** is a configuration view illustrating an outline of a configuration of feeder **30**.

FIG. **4** is a configuration view illustrating an outline of a configuration of loader **50**.

FIG. **5** is a configuration view relating to a control by component mounting system **10**.

FIG. **6** is an explanatory diagram illustrating an example of feeder management information.

FIG. **7** is a flowchart illustrating an example of a feeder arrangement instruction related process.

FIG. **8** is an explanatory diagram illustrating an example of attachment and detachment instructions registered in instruction list L.

FIG. **9** is an explanatory diagram illustrating an example of the attachment and detachment instruction displayed on display **27**.

FIG. **10** is a flowchart illustrating an example of an attachment and detachment error handling process.

FIG. **11** is an explanatory diagram illustrating how the attachment and detachment instruction is additionally registered in instruction list L.

FIG. **12** is an explanatory diagram illustrating how the attachment and detachment instruction is additionally registered in instruction list L.

DESCRIPTION OF EMBODIMENTS

Next, an embodiment for the present disclosure will be described with reference to the drawings.

FIG. **1** is a configuration view illustrating an outline of a configuration of component mounting system **10** in the present embodiment, FIG. **2** is a configuration view illustrating an outline of a configuration of component mounter **20**, and FIG. **3** is a configuration view illustrating an outline of a configuration of feeder **30**. In addition, FIG. **4** is a configuration view illustrating an outline of a configuration of loader **50**, and FIG. **5** is a configuration view relating to a control by component mounting system **10**. The lateral direction in FIG. **1** is the X-direction, the longitudinal direction is the Y-direction, and the vertical direction is the Z direction.

As illustrated in FIG. **1**, component mounting system **10** includes printer **12**, printing inspector **14**, multiple component mounters **20**, a mounting inspector (not illustrated), loader **50**, in-line storage **60**, and management device **80**. Printer **12** prints solder on board S. Printing inspector **14** inspects a state of the solder printed by printer **12**. Multiple component mounters **20** are installed side by side along the conveyance direction (X-direction) of board S, and mount the components supplied from feeder **30** on board S. The mounting inspector inspects a mounting state of the components mounted by component mounter **20**. Loader **50** can automatically exchange feeder **30** between multiple component mounters **20**, and attaches a necessary feeder **30** or detaches used feeder **30**. In-line storage **60** stores feeder **30** scheduled to be used by component mounters **20** and used feeders **30**. Management device **80** manages the entire system. Printer **12**, printing inspector **14**, multiple component mounters **20**, and the mounting inspector are arranged side by side in the conveyance direction of board S in this order and form a production line. In-line storage **60** is incorporated in the production line in component mounting system **10**, and is installed between the most upstream component mounter **20** in the conveyance direction of board S among multiple component mounters **20** and printing inspector **14**. In the present embodiment, the operator transports feeder **30** stored in a storage warehouse (not illustrated) and replenish to in-line storage **60**, or the operator collects feeder **30** from in-line storage **60** and transports to the storage warehouse to store in the storage warehouse. In addition, the operator also attaches or detaches feeder **30** to component mounter **20** in order to support the automatic exchange by loader **50**. In addition to these devices, component mounting system **10** may include a reflow device that performs a reflow process of board S on which the components are mounted.

As illustrated in FIG. **2**, component mounter **20** includes board conveyance device **21** that conveys board S in the X-direction, head **22** that includes suction nozzle for picking up the components supplied by feeder **30**, and head moving mechanism **23** that moves head **22** in the XY-direction, and display **27** such as an LCD (refer to FIG. **1**). In addition, component mounter **20** includes mounting control device **28** (refer to FIG. **5**) which is configured with well-known CPU, ROM, RAM, and the like, to control the entire device. Mounting control device **28** outputs a control signal to board conveyance device **21**, head **22**, head moving mechanism **23**, display **27**, and the like. In addition, component mounter **20** has two upper and lower areas to which feeder **30** can be attached in the front. The upper area is supply area **20**A to which feeder **30** can supply the components, and the lower area is stock area **20**B in which feeder **30** can be stocked. Supply area **20**A and stock area **20**B are provided with feeder base **40** having an L-shaped side view and to which multiple feeders **30** are attached. Component mounter **20** need not have stock area **20**B.

As illustrated in FIG. **3**, feeder **30** is configured as a tape feeder that sends out a tape that accommodates the components at a predetermined pitch. Feeder **30** includes tape reel **32** in which the tape is wound, tape feeding mechanism **33** that sends out the tape from tape reel **32**, connector **35** having two positioning pins **34**, rail member **37** provided at the lower end, and feeder control device **39** (refer to FIG. **5**). As illustrated in FIG. **2**, feeder base **40** includes multiple slots **42** that are arrayed in the X-direction at an interval in which rail member **37** of feeder **30** can be inserted, two positioning holes **44**, and connector **45** provided between two positioning holes **44**. When rail member **37** of feeder **30** is inserted into slot **42** of feeder base **40**, two positioning pins **34** of feeder **30** are inserted into two positioning holes **44**, connector **35** and connector **45** are connected to each other. Feeder control device **39** is configured with well-known CPU, ROM, RAM, and the like, and outputs a drive signal to tape feeding mechanism **33**. In addition, feeder control device **39** can communicate with the control unit (mounting control device **28**, management device **80**, or the like.) to which feeder **30** is attached via the connections of connectors **35** and **45**.

As illustrated in FIG. **1**, loader **50** can move along X-axis rail **18** provided parallel to the conveyance direction (X-direction) of the board on the front of multiple component mounters **20** and the front of in-line storage **60**. In FIG. **2**, the illustration of X-axis rail **18** is omitted. As illustrated in FIGS. **4** and **5**, loader **50** includes loader moving mechanism **51**, feeder transfer mechanism **53**, encoder **57**, left and right monitoring sensors **58***a* and **58***b*, and loader control device **59**.

Loader moving mechanism **51** moves loader **50** along X-axis rail **18**, and includes X-axis motor **52***a* such as a servomotor that drives a driving belt and guide roller **52***b* that guides the movement of loader **50** along X-axis rail **18**. Feeder transfer mechanism **53** transfers feeder **30** to component mounter **20** or to in-line storage **60**. Feeder transfer mechanism **53** includes clamp section **54** that clamps feeder **30** and Y-axis slider **55** in which two clamp sections **54** are arranged, and two clamp sections **54** are integrally moved along Y-axis guide rail **55***b* in the longitudinal direction (Y-direction) by driving Y-axis motor **55***a*. Feeder transfer mechanism **53** includes two Y-axis sliders **55**, and total four clamp sections **54** are moved in the Y-direction in pairs by arranging two clamp sections **54** in each of two Y-axis sliders **55**. In addition, feeder transfer mechanism **53** includes Z-axis motor **56***a* that moves slide base **56** to which clamp section **54** and Y-axis slider **55** are slidably attached, in the vertical direction (Z direction) along Z-axis guide rail **56***b*.

Encoder **57** detects a movement position of loader **50** in the X-direction. Monitoring sensors **58***a* and **58***b* monitor the presence or absence of obstacles (including the operator), and are configured with, for example, infrared sensors. Monitoring sensor **58***a* is attached to the left side of loader **50** (opposite to the conveyance direction of board S), and mainly detects the obstacles in the monitoring area on the left side of loader **50**. Monitoring sensor **58***b* is attached to the right side of loader **50** (on the same side as the conveyance direction of board S), and mainly detects the obstacles in the monitoring area on the right side of loader **50**. Loader control device **59** is configured with a well-known CPU, ROM, RAM, and the like. Loader control device **59** inputs a detection signal from encoder **57** and monitoring sensors **58***a* and **58***b*, and outputs a drive signal to loader moving mechanism **51** (X-axis motor **52***a*) and feeder transfer mechanism **53** (clamp section **54**, Y-axis motor **55***a*, and Z-axis motor **56***a*).

When performing the automatic exchange of feeder **30**, first, loader control device **59** controls X-axis motor **52***a* to move loader **50** to slot **42** of component mounter **20** that performs the automatic exchange up to a position of facing Y-axis slider **55** of loader **50**. In addition, when performing the automatic exchange between supply area **20**A of component mounter **20**, loader control device **59** controls Z-axis motor **56***a* to move slide base **56** (Y-axis slider **55**) to upper transfer area **50**A facing supply area **20**A. On the other hand, when performing the automatic exchange between stock area **20**B of component mounter **20**, loader control device **59** controls Z-axis motor **56***a* to move slide base **56** to lower transfer area **50**B facing stock area **20**B. When attaching feeder **30** in loader **50** to component mounter **20**, loader control device **59** controls Y-axis motor **55***a* in a state where feeder **30** is clamped in clamp section **54** to move Y-axis slider **55** to component mounter **20** side (rearward). In this way, rail member **37** of feeder **30** is inserted into slot **42** of feeder base **40**. Subsequently, loader control device **59** attaches feeder **30** to feeder base **40** of component mounter **20** by releasing the clamp of feeder **30** by clamp section **54**. In addition, when detaching feeder **30** from component mounter **20** and collecting feeder **30** in loader **50**, loader control device **59** controls Y-axis motor **55***a* to move Y-axis slider **55** to component mounter **20** side (rearward). Subsequently, loader control device **59** clamps feeder **30** attached to feeder base **40** to clamp section **54**, and then, controls Y-axis motor **55***a* to move Y-axis slider **55** forward. In this way, feeder **30** is removed from feeder base **40** and is collected in loader **50**.

In order to accommodate multiple feeders **30**, in-line storage **60** is provided with feeder base **40** having the same configuration as feeder base **40** provided in component mounter **20**. Loader **50** can attach and detach feeder **30** to and from feeder base **40** in in-line storage **60** by the same operation as attaching and detaching feeder **30** to feeder base **40** of component mounter **20**. In addition, behind in-line storage **60**, board conveyance device **62** for conveying board S in the X-direction is provided. Board conveyance device **62** can convey board S received from the board conveyance device of printing inspector **14** and deliver board S to board conveyance device **21** of adjacent component mounter **20**.

As illustrated in FIG. **5**, management device **80** is configured with well-known CPU **80***a*, ROM **80***b*, HDD **80***c*, RAM **80***d*, and the like, and includes display **82** such as an LCD and input device **84** such as a keyboard and a mouse. Management device **80** stores jobs indicating production information of board S, feeder management information, and the like. In the jobs, which type of component will be mounted on board S in what order in each component mounter machine **20**, and how many boards S mounted in this manner will be produced, are defined. In addition, in the job, arrangement information is defined, which indicates the arrangement of feeders **30** suitable for the mounting process when multiple feeders **30** corresponding to the types of component to be mounted in each component mounter **20** are mounted on feeder base **40** of supply area **20**A. The feeder management information is information relating to feeder **30** held by each component mounter **20** and in-line storage **60**. FIG. **6** is an explanatory diagram illustrating an example of the feeder management information. As illustrated in FIG. **6**, the feeder management information includes a slot number of feeder base **40** to which each feeder **30** is mounted, a feeder ID (identification information) of feeder **30** attached to each slot **42**, and the type of component possessed by each feeder **30**, a remaining amount of the component, and the like. Each mounting control device **28** similarly manages its own feeder management information.

In addition, management device **80** is communicably connected to mounting control device **28** by wire and communicably connected to loader control device **59** wirelessly, and is also communicably connected to each control device such as printer **12**, printing inspector **14**, and mounting inspector. Management device **80** receives information relating to a mounting status of component mounter **20** and information relating to attached and detached feeder **30** (attachment and detachment record) from mounting control device **28**, and receives information relating to a driving situation of loader **50** from loader control device **59**. When the information relating to feeder **30** attached to feeder base **40** of component mounter **20** and feeder **30** removed from feeder base **40** is received from mounting control device **28**, management device **80** updates the feeder management information of component mounter **20**. In addition, if the attached and detached feeder **30** is based on instruction list L to attach and detach to and from component mounter **20**, an update process for instruction list L is performed as described later. In addition, management device **80** outputs a drive signal to board conveyance device **62** of in-line storage **60** and causes board conveyance device **62** to convey board S. In addition, management device **80** is communicably connected to feeder control device **39** of feeder **30** attached to feeder base **40** of in-line storage **60** via connectors **35** and **45**, and can acquire the information on feeder **30**. When the information relating to feeder **30** attached to feeder base **40** of in-line storage **60** and feeder **30** removed from feeder base **40** is acquired, management device **80** updates the feeder management information in in-line storage **60**.

The operation of component mounting system **10** configured in this manner, particularly the operation when instructing the arrangement of feeder **30** will be described. In the present embodiment, the instruction for arranging feeder **30** is not only output as an automatic exchange instruction to loader **50**, but is also output such that the operator can recognize. FIG. **7** is a flowchart illustrating an example of the feeder arrangement instruction related process. This process is executed by CPU **80***a* of management device **80**. In the feeder arrangement instruction related process, first, CPU **80***a* first acquires instruction list L for the attachment and detachment of feeder **30** (S**100**), and outputs the exchange instruction of feeder **30** to loader **50** and component mounter **20** based on instruction list L (S**110**).

FIG. **8** is an explanatory diagram illustrating an example of attachment and detachment instructions registered in

instruction list L. In the attachment and detachment instructions registered in instruction list L, a feeder ID of feeder **30** to be attached and detached, a component type, and whether the target to be attached and detached is in-line storage **60** or multiple component mounters **20**, a slot number (attachment and detachment position) in that target, and a type of attachment and detachment indicating whether it is attached or detached, are associated with each other. The component type may be omitted. Multiple component mounters **20** are, for example, component mounters **20** (**1**), (**2**), . . . in an order from the upstream. In addition, instruction list L is basically a list for causing loader **50** to perform the automatic exchange of feeder **30**, and the instruction number indicates the order of automatic exchange by loader **50**. Therefore, loader control device **59** performs the automatic exchange of feeder **30** by controlling loader **50** so that the attachment and detachment of feeder **30** are performed according to an order of the instruction number of each attachment and detachment instruction in instruction list L. However, the operator may perform the exchange of feeder **30**, and in that case, the operator does not need to perform according to the instruction number, and can selectively exchange any of the feeders. In FIG. **8**, for example, the instruction numbers **1** to **4** indicate the instruction to remove feeder **30** corresponding to its feeder ID from the slot numbers **2**, **5**, **13**, and **19** in in-line storage **60**. In addition, for feeder **30** removed by the instruction numbers **1** and **2**, the instruction numbers **5** and **6** indicate the instruction to attach component mounter **20** (**1**) to slot numbers **4** and **5**, and for feeder **30** removed by the instruction numbers **3** and **4**, the instruction numbers **9** and **10** indicate the instruction to attach component mounter **20** (**2**) to slot numbers **1** and **2**. As described above, in instruction list L, multiple attachment and detachment instructions of feeder **30** performed by in-line storage **60** and multiple component mounters **20** are registered. In FIG. **8**, for convenience of explanation, the movement destination of each feeder **30** is indicated by an arrow, but instruction list L need not have the arrow indicating the movement destination as long as the attachment and detachment instruction is provided. Instruction list L may be created by management device **80**, may be created by a higher-level management device that collectively manages multiple production lines, or may be registered in HDD **80***c*.

In addition, FIG. **9** is an explanatory diagram illustrating an example of the attachment and detachment instruction displayed on display **27**. This is an example in which mounting control device **28** of each component mounter **20** displays the attachment and detachment instruction regarding its own device on display **27** based on the attachment and detachment instruction output to component mounter **20** in S**110**. FIG. **9** illustrates what is displayed on display **27** by mounting control device **28** of component mounter **20** (**1**). Therefore, among the instructions in instruction list L in FIG. **8**, the instructions (instruction numbers **5** and **6** in FIG. **8**) to attach feeder **30** detached from in-line storage **60** (instruction numbers **1** and **2** in FIG. **8**) to the slot numbers **4** and **5** of component mounter **20** (**1**) which is its own device, are displayed. In addition, the instructions (instruction numbers **11** and **12** in FIG. **8**) to attach feeder **30** detached from the slot numbers **7** and **9** of component mounter **20** (**1**) which is its own device (instruction numbers **7** and **8** in FIG. **8**) to in-line storage **60** are displayed. Although not illustrated, the attachment and detachment instructions are similarly displayed on display **27** of other component mounters **20**. Therefore, the operator can recognize the attachment and detachment instruction from display **27** of each component mounter **20** and can perform the exchange work of feeder **30**. The management device **80** may cause the operator to recognize the attachment and detachment instruction by displaying instruction list L on display **82** in S**110**, or by printing instruction list L on a paper medium such as paper. In addition, if the operator has a mobile terminal and the like for work, the operator may be caused to recognize the attachment and detachment instruction by outputting instruction list L from management device **80** to the mobile terminal via wireless communication and displaying instruction list L on the screen of the mobile terminal.

When the exchange instruction is output in S**110**, CPU **80***a* waits for receiving an attachment and detachment notification indicating that the attachment and detachment of feeder **30** is performed from mounting control device **28** of each component mounter **20** (S**120**). When the attachment and detachment of feeder **30** to feeder base **40** is performed, mounting control device **28** transmits the attachment and detachment notification that includes an attachment and detachment record in which a feeder ID of attached and detached feeder **30**, a slot number (attachment and detachment position), and a type of attachment and detachment for indicating whether it is the attachment or the detachment are associated with each other, to the management device **80**. In the attachment and detachment record, the component type may be associated. Even when the attachment and detachment of feeder **30** is performed by any one of loader **50** or the operator, mounting control device **28** transmit the attachment and detachment notification to management device **80**. When it is determined that the attachment and detachment notification is received in S**120**, CPU **80***a* acquires the feeder ID, the slot number, and the type of attachment and detachment as the attachment and detachment record included in the attachment and detachment notification, (S**130**).

Next, CPU **80***a* collates the acquired attachment and detachment record with the attachment and detachment instruction registered in instruction list L (S**140**), and determines whether the attachment and detachment of feeder **30** is performed according to the attachment and detachment instruction in instruction list L (S**150**). If the attachment and detachment instruction in which any of the feeder ID, the slot number, and the type of attachment and detachment match with those included in the attachment and detachment record is registered in instruction list L, CPU **80***a* determines that the attachment and detachment is performed according to the attachment and detachment instruction. When it is determined in S**150** that the attachment and detachment is performed according to the attachment and detachment instruction, CPU **80***a* deletes the corresponding attachment and detachment instruction from instruction list L to update instruction list L (S**160**). Then, update information of instruction list L is output to loader **50** and component mounter **20** (S**170**). As the update information, because the attachment and detachment of feeder **30** based on the attachment and detachment instruction is already performed, information to delete the attachment and detachment instruction is output. Loader control device **59** that received the update information deletes the attachment and detachment instruction from the already received attachment and detachment instruction. Therefore, it is possible to prevent loader **50** from performing the automatic exchange of feeder **30** based on the attachment and detachment instruction in duplicate. In addition, in S**170**, CPU **80***a* may output update information to component mounter **20** targeted by the deleted attachment and detachment instruction. Mounting control device **28** of component mounter **20** that received the update information performs a process of deleting the

attachment and detachment instruction from the display on display **27**. Therefore, it is possible to prevent the operator from performing the exchange of feeder **30** based on the attachment and detachment instruction in duplicate. Therefore, it is possible to appropriately prevent the exchange of feeder **30** already performed by any one of loader **50** and the operator from being performed by the other.

On the other hand, when it is determined in S**150** that the attachment and detachment is not performed according to the attachment and detachment instruction, CPU **80***a* determines that the operator performed the attachment and detachment work that is different from the attachment and detachment instruction, and then, executes an attachment and detachment error handling process (S**180**). When the processes of S**170** or S**180** is executed, CPU **80***a* determines whether the attachment and detachment of all feeders **30** are completed (S**190**), if it is determined not to be completed, performs a return process to S**120**, and if it is determined to be completed, ends the feeder arrangement instruction related process. Hereinafter, the attachment and detachment error handling process in S**180** will be described.

FIG. **10** is a flowchart illustrating an example of the attachment and detachment error handling process. In the attachment and detachment error handling process, CPU **80***a* determines whether the current attachment and detachment error is a detachment error for feeder **30** (S**200**). CPU **80***a* determines that it is a detachment error or the like when feeder **30** which is not in the attachment and detachment instruction is detached, and determines that it is an attachment error or the like when feeder **30** which is not in the attachment and detachment instruction is attached, or when feeder **30** is attached to slot **42** that is different from the slot number designated in the attachment and detachment instruction. When it determined in S**200** that it is the attachment error rather than the detachment error, CPU **80***a* additionally registers the attachment and detachment instruction into instruction list L, instruction of which detaching feeder **30** corresponding to the attachment error and attaching the same to the correct position (S**210**). Then, CPU **80***a* outputs a correction attachment and detachment instruction for correcting the current attachment error based on the additionally registered instruction list L (S**250**), and ends the attachment and detachment error handling process. CPU **80***a* output the attachment and detachment instruction in S**250** to loader **50** and component mounter **20**. Therefore, the attachment error by the operator can be corrected by loader **50**. In addition, by mounting control device **28** of component mounter **20** displaying the correction attachment and detachment instruction on display **27**, the operator can also correct the error based on the attachment and detachment instruction.

Here, FIG. **11** is an explanatory diagram illustrating how the attachment and detachment instruction is additionally registered in instruction list L. FIG. **11** illustrates an example in which the attachment and detachment instruction for correcting the attachment error is additionally registered. In this example, a case is assumed, in which feeder **30** with the feeder ID "**B**5**" has to be attached to the slot number **5** of component mounter **20** (**1**) (instruction number **6**), but the operator erroneously attaches the feeder to the slot number **6**. In this case, CPU **80***a* additionally registers an attachment and detachment instruction (***1**) so as to detach the feeder **30** from the slot number **6** and attach the feeder to the slot number **5**. In FIG. **11**, the instruction number of the attachment and detachment instruction additionally registered is set to be ***1** for the convenience of explanation, but CPU **80***a* may reassign the instruction number including the additionally registered attachment and detachment instruction. In addition, FIG. **11** illustrates a state in which the attachment and detachment instruction to detach the feeder from the slot number **6** is additionally registered while leaving the attachment and detachment instruction in the instruction number **6**, but CPU **80***a* may delete the attachment and detachment instruction (instruction number **6**) to attach the feeder to the slot number **5** at the time when the attachment error is detected, and then, may additionally register the attachment and detachment instruction to attach the feeder to the slot number **5**. When feeder **30** is attached and detached based on the additionally registered attachment and detachment instruction, CPU **80***a* determines that the instruction is performed according to instruction in S**150** described above, and performs the process.

In addition, when it is determined in S**200** that the current attachment and detachment error is a detachment error, CPU **80***a* searches for feeder **30** erroneously detached by the operator (S**220**), and determines whether the target feeder **30** can be located (S**230**). In this case, since feeder **30** that is erroneously detached may be attached to in-line storage **60** by the operator, CPU **80***a* searches the in-line storage **60**. CPU **80***a* may perform the search in S**220** for a predetermined time and then may perform the determination in S**230** while taking the time for the operator to move to in-line storage **60** into consideration. If the erroneously detached feeder **30** is attached to another component mounter **20**, CPU **80***a* determines that the attachment and detachment is not performed according to the instruction in S**150** described above, and performs this attachment and detachment error handling process. In this case, CPU **80***a* can determine in S**200** that it is the attachment error, and executes S**210** and S**250**, and makes the correction as described above.

When it is determined that feeder **30**, being erroneously detached, can be located, CPU **80***a* additionally registers the attachment and detachment instruction into instruction list L, instruction of which attaching the target feeder **30** to the original position by detaching the same from the located place (S**240**). Then, CPU **80***a* outputs the correction attachment and detachment instruction for correcting the current detachment error based on additionally registered instruction list L (S**250**), and ends the attachment and detachment error handling process. In this case also, the detachment error of the operator can be corrected by loader **50**. In addition, it is also possible for the operator to make correction based on the correction attachment and detachment instruction displayed on display **27**.

Here, FIG. **12** is an explanatory diagram illustrating how the attachment and detachment instruction is additionally registered in instruction list L. FIG. **12** illustrates an example in which the attachment and detachment instructions for correcting the detachment errors are additionally registered. In this example, a case is assumed, in which the operator erroneously detaches feeder **30** having the feeder ID "**F**2**" and is attached to the slot number **6** of component mounter **20** (**1**) by an error as the instruction number **7**, and attaches the feeder to the slot number **2** of in-line storage **60**. In this case, CPU **80***a* determines that feeder **30** can be located from in-line storage **60**, and additionally register the attachment and detachment instructions (***2** and ***3**) so as to detach feeder **30** from the slot number **2** of in-line storage **60** and to attach the feeder to the slot number **6** of component mounter **20**(**1**) that is the original position. In this case also, CPU **80***a* may reassign the instruction number including the additionally registered attachment and detachment instruction. In addition, when feeder **30** is attached and detached based on the additionally registered attachment and detach-

ment instruction, CPU **80***a* determines that the instruction is performed according to the instruction in S**150** described above and performs the process.

In addition, as a result of the search in S**220**, if it is determined in S**230** that erroneously detached feeder **30** cannot be located, CPU **80***a* notifies a fact that target feeder **30** is erroneously detached and cannot be located (S**260**), and ends the attachment and detachment error handling process. In this case, CPU **80***a* determines that feeder **30** of the detachment error is transported to another location different from in-line storage **60**, for example, the storage warehouse, and performs the process in S**260**. In addition, CPU **80***a* can send the notification in S**260** to component mounter **20** from which feeder **30** is erroneously detached. If mounting control device **28** of component mounter **20** that has received the notification displays the notification content on display **27**, it becomes possible for the operator to take an action. Further, the notification in S**260** may be performed by outputting a voice from a speaker (not illustrated), turning on or blinking a warning lamp, or the like. Since it is desirable that such notification is performed as soon as possible after the operator erroneously detach feeder **30**, the notification in S**260** may be performed while searching in S**220** is performed. In addition, if multiple production lines are arranged adjacently, CPU **80***a* may perform the notification in S**260** to management device **80** that manages another production line or a higher-level management device that centrally manages multiple production lines.

Here, the correspondence relationship between the configuration elements in the present embodiment and the configuration elements in the present disclosure will be clarified. Feeder **30** in the present embodiment corresponds to a component supply unit, component mounter **20** corresponds to a component mounter, and loader **50** corresponds to a unit exchange device, management device **80** that executes the feeder arrangement instruction related process in S**110** in FIG. **7** corresponds to an instruction output section, management device **80** that executes the feeder arrangement instruction related process in S**130** corresponds to an acquisition section, and management device **80** that executes the feeder arrangement instruction related process in S**140** to S**180** corresponds to a processing section.

Since the exchange instruction of feeder **30** is output based on instruction list L so as to be recognizable by the operator, component mounting system **10** described above can cause not only loader **50** but also the operator to exchange feeder **30**. In addition, if feeder **30** is attached and detached, component mounting system **10** determines whether the attachment and detachment are performed according to the attachment and detachment instruction in instruction list L, and if the attachment and detachment are performed according to the attachment and detachment instruction, deletes the corresponding attachment and detachment instruction and updates the instruction list L. Therefore, since it is possible to prevent the attachment and detachment of feeder **30** already performed by any one of loader **50** and the operator from being performed by the other in duplicate, and thus, the cooperative operation by loader **50** and the operator can be appropriately performed.

In addition, in component mounting system **10**, since the attachment and detachment error handling process is performed when the attachment and detachment of feeder **30** is not performed according to the attachment and detachment instruction, it is possible for the operator to appropriately handle the attachment and detachment error.

In addition, in component mounting system **10**, if the attachment of feeder **30** is not performed according to the attachment and detachment instruction, an attachment and detachment instruction for detaching feeder **30** and attaching the feeder to an appropriate position is additionally registered in instruction list L, and a new exchange instruction is output. Therefore, when the attachment of feeder **30** is not performed according to the instruction, the feeder can be appropriately reattached by loader **50**.

In addition, in component mounting system **10**, if the detachment of feeder **30** is not performed according to the attachment and detachment instruction, that feeder **30** is searched, and if feeder **30** is located, the attachment and detachment instruction for detaching feeder **30** and for attaching the feeder to the original position is additionally registered in instruction list L, and then, a new exchange instruction is output. Therefore, even when the detachment of feeder **30** is not performed according to the instruction, the feeder can be appropriately reattached by loader **50**. In addition, if feeder **30** is not located, since that effect is notified, it is possible for the operator or the like to make a correction handling.

It goes without saying that the present disclosure is not limited to the embodiment described above, and can be implemented in various aspects as long as it belongs to the technical scope of the present disclosure.

For example, in the embodiment described above, when the attachment of feeder **30** is not performed according to the attachment and detachment instruction, the attachment and detachment instruction for detaching feeder **30** and attaching the feeder to the appropriate position is additionally registered in instruction list L, but the present disclosure is not limited to this. For example, when the attachment of feeder **30** is not performed according to the attachment and detachment instruction, the attachment error may be immediately notified to the operator. For example, this notification of error can be displayed on display **27** of component mounter **20**.

In the embodiment described above, if the detachment of feeder **30** is not performed according to the attachment and detachment instruction, a different handling is performed depending on whether feeder **30** is located, but the present disclosure is not limited to this. For example, if the detachment of feeder **30** is not performed according to the attachment and detachment instruction, a process of notifying the operator of the detachment error may be uniformly performed.

In the embodiment described above, in any case where the attachment of feeder **30** is not performed according to the attachment and detachment instruction and where the detachment of feeder **30** is not performed according the attachment and detachment instruction, a new attachment and detachment instruction is recognizably output to the operator, but the present disclosure is not limited to this. For example, the new attachment and detachment instruction may be output only to loader **50** without making it recognizable by the operator.

In the embodiment described above, the deletion or the additional registration of the attachment and detachment instruction to or from the instruction list L is performed by management device **80**, but the present disclosure is not limited to this. For example, loader control device **59** that received the necessary information from management device **80** may perform the deletion or additional registration of the attachment and detachment instruction to or from instruction list L.

In the embodiment described above, component mounter **20** includes stock area **20**B, but this may not be included. In

this case, loader **50** may not include lower transfer area **50**B, or lower transfer area **50**B may be used as the stock area of feeder **30** in loader **50**.

In the component mounting system in the present disclosure, when it is determined that the attachment and detachment of the component supply unit is performed according to the attachment and detachment instruction, the processing section may perform the handling process such that the component supply unit is reattached and detached. In this way, since it becomes possible to handle the case where the attachment and detachment of the component supply unit is erroneously performed by the operator instead of being performed according to the attachment and detachment instruction, the cooperative operation can be performed more appropriately.

In the component mounting system in the present disclosure, when it is determined that the attachment of the component supply unit is not performed according to the attachment and detachment instruction, as the handling process, the processing section may perform an update process of the instruction list by additionally registering the attachment and detachment instruction for detaching the component supply unit and attaching to an appropriate position, and when the instruction list is updated by the additional registration of the attachment and detachment instruction, the instruction output section may output a new exchange instruction. In this way, even if the attachment of the component supply unit is not performed according to the instruction, the unit exchange device can appropriately perform the reattachment.

In the component mounting system in the present disclosure, when it is determined that the detachment of the component supply unit is not performed according to the attachment and detachment instruction, as the handling process, the processing section may search for the detached component supply unit, and if the component supply unit is located, perform the update process of the instruction list by additionally registering the attachment and detachment instruction for attaching the component supply unit to the original position, and if the component supply unit is not located, may perform the notification process to notify that fact, and when the update process of the instruction list is performed with the additional registration of the attachment and detachment instruction, the instruction output section may output a new exchange instruction. In this way, even if the detachment of the component supply unit is not performed according to the instruction, if the component supply unit is located, the component supply unit can be appropriately returned by the unit exchange device. In addition, if the component supply unit is not located, it is possible to handle the error by an operator by notifying this fact.

INDUSTRIAL APPLICABILITY

The present disclosure can be used in the manufacturing industry of component mounting systems and the like.

REFERENCE SIGNS LIST

10 component mounting system, **12** printer, **14** printing inspector, **18** X-axis rail, **20** component mounter, **20**A supply area, **20**B stock area, **21** board conveyance device, **22** head, **23** head moving mechanism, **27** display, **28** mounting control device, **30** feeder, **32** tape reel, **33** tape feeding mechanism, **34** positioning pin, **35** connector, **37** rail member, **39** feeder control device, **40** feeder base, **42** slot, **44** positioning hole, **45** connector, **50** loader, **50**A upper transfer area, **50**B lower transfer area, **51** loader moving mechanism, **52***a* X-axis motor, **52***b* guide roller, **53** feeder transfer mechanism, **54** clamp section, **55** Y-axis slider, **55***a* Y-axis motor, **55***b* Y-axis guide rail, **56** slide base, **56***a* Z-axis motor, **56***b* Z-axis guide rail, **57** encoder, **58***a*, **58***b* monitoring sensor, **59** loader control device, **60** in-line storage, **62** board conveyance device, **80** management device, **80***a* CPU, **80***b* ROM, **80***c* HDD, **80***d* RAM, **82** display, **84** input device, L instruction list, S board.

The invention claimed is:

1. A component mounting system that includes a component mounter in which multiple component supply units that supply components are detachably arranged, the system comprising:

a loader configured to automatically exchange one component supply unit of the multiple component supply units between the loader and the component mounter;

an instruction output section configured to output an exchange instruction of the component supply units, including an automatic exchange instruction to the loader, so as to be recognizable by an operator, based on an instruction list in which multiple attachment and detachment instructions are registered,

in which a type of attachment and detachment, indicating the attachment or the detachment, are associated with identification information identifying the component supply unit targeted to be attached and detached, and positional information for the attachment and detachment in the component mounter;

an acquisition section configured to acquire an attachment and detachment record that includes the identification information on the component supply unit, the positional information on the attachment and detachment, and the type of attachment and detachment when the component supply unit is attached and detached on the component mounter; and

a processing section configured to determine whether the attachment and detachment of the component supply unit is performed according to the attachment and detachment instruction based on the attachment and detachment record acquired by the acquisition section and the instruction list, and when it is determined that the attachment and detachment is performed according to the attachment and detachment instruction, perform an update process to update the instruction list by deleting the corresponding attachment and detachment instruction.

2. The component mounting system according to claim **1**,

wherein the processing section is configured to perform an handling process such that the component supply unit is reattached and redetached when it is determined that the attachment and detachment of the component supply unit is not performed according to the attachment and detachment instruction.

3. The component mounting system according to claim **2**,

wherein the processing section is configured to perform an update process of the instruction list by additionally registering the attachment and detachment instruction for detaching the component supply unit and attaching the component supply unit to an appropriate position as the handling process when it is determined that the attachment of the component supply unit is not performed according to the attachment and detachment instruction, and

the instruction output section is configured to output a new exchange instruction when the instruction list is

updated by the additional registration of the attachment and detachment instruction.

4. The component mounting system according to claim **2**, wherein the processing section is configured to search for the detached component supply unit as the handling process when it is determined that the detachment of the component supply unit is not performed according to the attachment and detachment instruction, and perform the update process of the instruction list by additionally registering the attachment and detachment instruction for detaching the component supply unit and attaching the component supply unit to an original position if the component supply unit is located, and perform a notification process to notify that fact if the component supply unit is not located, and

the instruction output section is configured to output a new exchange instruction when the update process of the instruction list is performed with the additional registration of the attachment and detachment instruction.

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